CERRO GRANDE FIRE
FLOOD FIGHT PLAN

LOS ALAMOS COUNTY SITES

PART 1-ADVANCE MEASURES AND EMERGENCY TECHNICAL ASSISTANCE PLAN

PURPOSE: Proposed is a two-part plan for the threat of potential flooding from approaching monsoon rains at Los Alamos County, Santa Fe County, Department of Energy, and tribal lands. The threat was created by the Los Alamos fires of May 2000 that burned off the vegetation from the steep canyon slopes and baked the soil that will dramatically increase the amount of run off from the monsoon rains. The intent of the first part of the plan is to outline advance measures projects for protection against flooding. The second part of the plan is intended to present flood fighting, monitoring, communicating, and evacuating suggestions that will augment the Los Alamos County, the Department of Energy, the San Ildefonso Pueblo, and the Santa Clara Pueblo emergency contingency plans.

AUTHORITY: The United States Army Corps of Engineers (Corps) is authorized to provide technical assistance and project construction that is requested by and funded by other federal agencies (i.e., Department of Energy, Bureau of Indian Affairs, Department of the Interior, Federal Emergency Management Agency).

Public Law (PL) 84-99 provides authority for the Corps to perform activities to protect against loss of life and damages to urban areas and/or public facilities due to flooding. Assistance activities to prevent damages may be taken prior to a flood.

LOS ALAMOS COUNTY REQUESTS FOR ASSISTANCE: Los Alamos County Emergency Operations requested technical assistance to identify areas at risk from the potential flood threat, make advance measures recommendations, design a solution to the risk, and construct the recommended solutions. The following is an itemized list of risk areas and solution recommendations.

SITE NO. LA-1: School Creek Near 45th and Arizona

A. Facility Description: School creek passes under Arizona Street near 45th Street through twin elliptical CMP culverts. The culverts are 2 feet 6 inches high and 3 feet 9 inches wide. Arizona Street is approximately 25 feet wide and approximately 6 feet 5 inches above the channel bottom. The downstream channel bottom is approximately 11 feet wide with an approximately top-of-bank width of 29 feet. The slope between Arizona Street and the outlet end of the structure is grouted rock protection.

B. Flood Control Recommendations: (See Figure 2) No advance measures are recommended for this structure.

C. Additional Requirements: In anticipation of the large flows expected, it is recommended that the county monitor this type of drainage structure during and after rainfall events and clean any debris that may be blocking them. It is also recommended that the police monitor the roads over the canyon for overtopping and place warning signs or close roads.

D. Costs: Measures shall be accomplished with County resources.

E. Schedule: Monitoring will be accomplished during each rainstorm. Culverts should be cleaned within 24 hours of the end of each rainstorm.

SITE NO. LA-2: School Creek Near 45th and Alabama Avenue

A. Facility Description: School creek passes under Alabama Avenue near 45th street through twin elliptical CMP culverts. The culverts are approximately 2 feet 6 inches high and 3 feet 9 inches wide. Alabama Avenue is approximately 25 feet wide. The upper part of the slope between Alabama Avenue and the outlet end of the structure is grassed and the lower part of the slope has grouted rock protection.

B. Flood Control Recommendations: (See Figure 3) As a temporary measure to protect the upper part of the slope above the outlet works it is recommended that a geotextile fabric be anchored down across the grass and soil slope to protect it from erosion in the event the road is overtopped by high flows. As a temporary measure to keep high flows from overtopping Alabama Avenue it is recommended that a sandbag dike be constructed along the upstream side of Alabama Avenue. The dike would wrap around to high ground on both sides of the drainage structure. The distance of the dike would be approximately 80 feet long. The sandbag dike should be three times as wide as it is high. The cross section of the dike would be constructed in the shape of a pyramid 2 feet high with a base width of 6 feet. It is estimated that the dike would take 1,000 filled sandbags to build (20 tons of sand). The work of filling, transporting, and placing the sandbags will be contracted out.

In addition, two houses (addresses: 4391 Alabama and 4431 Alabama A/B) because of their proximity to the canyon and topography of their yards may wish to construct sandbag dikes around the rear of both houses. The occupants of these dwellings should be contacted and advised of the possible threat of flooding or debris damage from high flows. It is estimated that the distance of the dike would be 80 feet long, 3 feet high, with a 9-feet-wide base. It is estimated that the dike would take 1,700 filled sandbags to build (34 tons of sand). Sandbags should only be filled to one half to two thirds full and untied for proper placing.

The Corps has given the County sandbags. The County, in turn, will provide the sandbags and the sand to the homeowner who will place them. In some cases the county may provide the volunteer labor or

contract labor for constructing the dike.

C. Additional Requirements: In anticipation of the large flows expected, it is recommended that the county monitor this type of drainage structure during and after rainfall events and clean any debris that may be blocking them. It is also recommended that the police monitor the roads over the canyon for overtopping to place warning signs or close roads.

D. Cost: The estimated cost for implementation of the sandbag dike is $4,700. The estimated cost for protecting the two houses with a sandbag dike is $8,000.

E. Schedule: Two days will be required to construct the sandbag dike. Monitoring shall be accomplished during each rainstorm. Culverts should be cleaned within 24 hours after rainstorms.

SITE NO. LA-3: School Creek at Arkansas Avenue and Glen Canyon sub-division bridge near 45th Street

A. Facility Description: School Creek passes under Arkansas Avenue near 45th street through a 60-inch CMP culvert. The School Creek channel then passes under the Glen Canyon Sub-division Bridge. The concern is that if high flows overtop Arkansas Avenue it will flow down Glen Canyon sub-division Road across the Glen Canyon Bridge and flow against the first house of the housing development.

B. Flood Control Recommendations: (See Figure 4) As a temporary measure to keep high flows from flowing against the house a sandbag dike should be constructed between the Glen Canyon Bridge and the first house to direct the flows back into School Canyon. The dike would extend from Glen Canyon Road to the School Canyon channel bank and be located approximately 30 feet away from the house. The distance of the dike would be approximately 30 feet long. The sandbag dike should be three times as wide as it is high. The cross section of the dike would be constructed in the shape of a pyramid 2 feet high with a base width of 6 feet. It is estimated that the dike would take 600 filled sandbags to build (12 tons of sand). Sandbags should only be filled to one half to two thirds full and untied for proper placing. The Corps has given the County sandbags. The County, in turn, will provide the sandbags and the sand to the contractor who will fill, transport, and place them. An armored riprap apron needs to be installed below the new outfall culvert out of the Glen Canyon subdivision. The county will either construct the riprap apron below the new outfall culvert or require the development owner to construct the riprap apron.

C. Additional Requirements: In anticipation of the large flows expected, the county should monitor this type of drainage structure during and after rainfall events and clean any debris that may be blocking them. It is also recommended that the police monitor the roads over the canyon for overtopping to place warning signs or close roads.

D. Cost: Estimated cost to implement these measures is $2,900.

E. Schedule: One and a half days are projected for construction of the sandbag structures.

SITE NO. LA-4: Walnut Canyon at 35th and Diamond Drive

A. Facility Description: Walnut canyon passes under Diamond Drive and 35th street. Several other storm drains also pass under these streets. The concern is that if high flows overtop Diamond Drive and 35th Street it will flood the intersection.

B. Flood Control Recommendations: (See Figure 5) It is recommended that the police monitor the roads over the canyon for overtopping and to place warning signs or close roads.

C. Additional Requirements: In anticipation of the large flows expected, it is recommended that the county monitor this type of drainage structure during and after rainfall events and clean any debris that may be blocking them. It is also recommended that the police monitor the roads over the canyon for overtopping to place warning signs or close roads.

D. Cost: Measures shall be accomplished with County resources.

E. Schedule: Monitoring shall be accomplished during each rainstorm. Culverts shall be cleaned within 24 hours after rainstorms.

SITE NO. LA-5: Walnut Canyon at Diamond Drive and 36th Street

A. Facility Description: Walnut Canyon passes under 36th street through a 30-in. CMP culvert. The concern is that if high flows overtop 36th Street they will flow against the house on the northeast corner (3454 36th Street). Overtopping flows could also flow down Diamond Drive.

B. Flood Control Recommendations: (See Figure 5) As a temporary measure to keep high flows from flowing against the house a sandbag dike should be constructed between the Walnut Canyon and the house at 3454 36th Street. The dike would extend from 35th Street, upslope of the canyon, and extend around the front corner of the house toward the back of the house. The distance of the dike would be approximately 60 feet long. The sandbag dike should be three times as wide as it is high. The cross section of the dike would be constructed in the shape of a pyramid 2 feet high with a base width of 6 feet. It is estimated that the dike would take 600 filled sandbags to build (12 tons of sand**).** Sandbags should only be filled to one half to two thirds full and untied for proper placing. The Corps has loaned the County sandbags. The Corps policy is to loan the sandbags to the requestor who will pay for the sandbags or replace them with sandbags of the same quality. The County, in turn, will provide the sandbags and the sand to the homeowner who will place them. In some cases the county may provide the volunteer labor or contract labor for constructing the dike.

C. Additional Requirements: In anticipation of the large flows expected, it is recommended that the county monitor this type of drainage structure during and after rainfall events and

clean debris that may be blocking them. It is also recommended that the police monitor the roads over the canyon for overtopping and to place warning signs or close roads.

D. Cost: Estimated cost to place this sandbag dike is $2,900.

E. Schedule: Two days are projected for construction of the sandbag structures.

SITE NO. LA-6: 47th Street cul-de-sac near Urban Street

A. Facility Description: This area was inspected for potential sheet flow from streets, but it appears that there are no post-fire flood concerns at this location.

B. Flood Control Recommendations: (See Figure 6) None.

C. Additional Requirements: None

D. Cost: None

E. Schedule: None

SITE NO. LA-7: North Branch of Pueblo Canyon at North Road

A. Facility Description: This area was inspected but it appears that the County is addressing post-fire flood concerns.

B. Flood Control Recommendations: (See Figure 7) None.

C. Additional Requirements: In anticipation of the large flows expected, the Corps recommends that the county monitor this drainage structure during and after rainfall events and clean debris that may be blocking them. It is also recommended that the police monitor the road over the canyon for overtopping and to place warning signs or close roads.

D. Cost: Measures shall be accomplished with County resources.

E. Schedule: Monitoring shall be accomplished during each rainstorm. Culverts should be cleaned within 24 hours after rainstorms.

SITE NO. LA-8: Diamond Drive

A. Facility Description: This structure is a roadway embankment crossing over Pueblo Canyon with an 18-inch-diameter low-level outlet culvert drain and a 36-inch-diameter spillway outlet culvert. Diamond Drive was not intended to be a permanent impoundment structure. The culverts are undersized for the anticipated new flow estimates.

B. Flood Control Recommendations: (See Figure 8 and 9) In anticipation of the large flows and the impoundment of water behind the roadway embankment and possible overtopping, it is suggested a 96-inch diameter outlet pipe be pipe jacked through the embankment. The downstream end of the embankment will have to be excavated to prepare a good working surface for the pipe jacking operation. A survey of the structure and surrounding area should be completed to accurately locate the pipe jacking equipment and to direct the pipe jacking operation. Pumping of the area on the upstream side of the road embankment may be required to keep the construction area dry. Confined space safety requirements will have to be incorporated into the construction plans. Safety precautions for monitoring suspect embankment slopes and alerting workers, evacuating the work site, and closing the road will have to be exercised in case of a slope failure. Also safety precautions for alerting and evacuating the work site should be taken in the event of fast developing flows in the canyon. A person with geotechnical experience should be assigned to monitor the effects of construction activity on the embankment and abutments. Evidence of seepage, movement, or any dangerous condition should be reported immediately to the Corps project manager. The County will be monitoring the RAWS (Remote Automated Weather Station) for potentially heavy storm flows, if these stations are alerted to heavy flows the County will notify the Corps and contractors working in the canyons. If the embankment fails or appears to be failing, both a Corps person and an LAPD officer will make the call to evacuate the canyon. The LAPD will position blockades across the road. The County will contact the agencies and Pueblos downstream, and the Corps person will contact the Corps Cerro Grande Recovery office in Los Alamos and the Albuquerque District Commander.

C. Additional Requirements: Safety precautions for closing the road and alerting the public should be taken by the contractor and county in the event of an embankment failure during construction or fast developing flows in the canyon. The Corps will have in place an emergency contingency plan during construction. Corps geotechnical personnel will monitor the construction site during construction to identify seepage, movement, or any dangerous conditions that might develop. Any unsafe conditions will be reported to the project manager immediately. A notification and evacuation plan will be in place. The plan will identify DOE, County, Tribal Governments, and Corps offices to be contacted.

D. Costs: Cost for implementing this measure is $3,662,400.

E. Schedule: The estimated schedule for this project, including mobilization and construction, is approximately six to eight weeks.

SITE NO. LA-9: Cañada de Beuy Arroyo passing under Bonnie View Drive near Longview Drive in White Rock

A. Facility Description: Cañada de Beuy arroyo passes under Bonnie View Drive through twin 6 foot by 6 foot box culverts (See Figure 11). The arroyo channel below Bonnie View Drive was being cleaned out and the outside channel curve slope was being armored with sandbags as shown in Figure 12. The arroyo continues parallel to Longview Drive and under Park Lane through twin 6 foot

by 6 foot box culverts (See Figure 13). Two 42-inch CMP culverts enter the Right Bank of the arroyo between Park Lane and the next unnamed channel crossing downstream. The small drainage channel upstream of the two 42-inch culverts is sandbagged to prevent the high flows from flooding the adjacent property on the East Side of Longview Drive (See Figure 14). From Park Lane the arroyo continues parallel to Longview Drive and passes through an unnamed apartment complex and road structure with twin 7-foot CMP culverts (See Figure 15). The arroyo then continues parallel to Longview Drive to Rover Boulevard (See Figure 16). The County is in the process of cleaning and shaping the arroyo channel, shaping the channel slopes, and protecting the newly shaped slopes along the outside curves with a layer of sandbags.

B. Flood Control Recommendations: (no figure shown) It appears that 20 percent of the watershed area drained by this canyon was burned. The measures that the County is undertaking should be effective in accomplishing protection of the residence and public buildings along this arroyo by increasing the capacity of the channel to handle higher flows if needed.

C. Additional Requirements: None

D. Cost: Measures shall be accomplished with County resources.

E. Schedule: Monitoring shall be accomplished during each rainstorm. Culverts shall be inspected and cleaned within 24 hours after each rainstorm. Debris should be removed from these channels to allow for maximum flows during storm events.

SITE NO. LA-10: Highway 4 and Pajarito Canyon near Pajarito Road

A. Facility Description: Pajarito Canyon passes under Highway 4 near Pajarito Rd. through three 36-inch CMP culverts. Approximately 60 feet downstream of Highway 4 there is a walkway/weir structure with two 24-inch CMP culverts. The channel approximately 100 feet downstream of the walkway/weir structure is mostly blocked with rocks and heavy brush and trees.

B. Flood Control Recommendations: (See Figure 17) It appears that Pajarito Canyon will have flows from the burn area (approximately 1,070 cfs before the DOE structure is in place and, 250 cfs after the structure is in place) that will exceed the capacity of the culverts under Highway 4, the walkway/weir structure, and the upper channel below Highway 4. If these high flows are experienced, Highway 4 will be overtopped. Hydrology data projections indicate that measures should be taken upstream of Highway 4 on Pajarito Canyon to detain or divert the expected flows exceeding the normal capacity at Highway 4 and through the community of White Rock. It is recommended that the 100-foot stretch of Pajarito channel below the walkway/weir be cleared. The trees, brush and rocks should be removed to increase the channel capacity between the Highway and the houses. It was reported that the state and/or county would accomplish this work. As a temporary measure to keep high flows and debris from flowing against the houses downstream of Highway 4, a sandbag dike should be constructed between the houses and the canyon channel. The occupants of these dwellings should be

contacted and
advised of the possible threat of flooding or debris damage from high flows. The distance of the dikes would be approximately 200 feet long. The cross section of the dikes would be constructed in the shape of a pyramid with a maximum height of 4 feet and a maximum base width of 12 feet. It is estimated that the dike would take 7,200 filled sandbags to build (144 tons of sand**).** Sandbags should only be filled to one half to two thirds full and untied for proper placing.

The Corps has given the County sandbags. The Corps policy on loaning the sandbags to the requestor has been changed to reflect the declared emergency resulting from the Cerro Grande Fire. Due to the presidential declaration, the sandbags are given to the municipalities free of charge. The County, in turn, will provide the sandbags and the sand to the homeowners who will place them. In some cases the county may provide the volunteer labor or contract labor for constructing the dike.

C. Additional Requirements: In anticipation of the large flows expected, the Corps recommends that the county monitor this type of drainage structure during and after rainfall events and clean debris that may be blocking them. It is also recommended that the police monitor the roads over the canyon for overtopping and to place warning signs or close roads.

D. Cost: Channel cleanout measures shall be accomplished with County resources. The estimated cost to place the sandbag dike at the houses is $21,600.

E. Schedule: Three days are estimated to accomplish these tasks.

SITE NO. LA-11: Diversion from Pajarito to Cañon de Valle above Highway 4

A. Facility Description: In order to reduce the flow down Pajarito Canyon which might impact facilities, residences, and transport soil downstream, another option is to divert the flow from the Pajarito arroyo to the Canon del Valle arroyo. This would only be necessary until the DOE advanced measures are completed upstream. The following recommendations are based upon the following assumptions: 1) The 100-year 6-hour unprotected upstream flow is 1,070 cubic feet per second (cfs). 2) The DOE upstream advance measures may not be completed before monsoon season is over. 3) The diversion channel will be constructed according to engineering specifications.

B. Flood Control Recommendations: (See Figure 14) A channel could be excavated along the Highway 4 right of way. The channel could be excavated in such a way the water could be redirected back into the LANL property on the West Side of the highway or into Portrillo Canyon.

C. Additional Requirements: This project option will probably require a 404 permit.

D. Costs: Estimated costs have not been calculated for this project. It is anticipated that at least a large bulldozer and hydraulic excavator would be required to dig this channel.

E. Schedule: No schedule has been established for this project.